of that quiet and retiring race, which people the beds of our streams. As the animal died, the valves of the shell opened, and decomposition commencing, the muscular adhesions gave way, and the fleshy portion rose to the surface of the water, leaving the shell in the bed of the stream. As these dead bodies floated down with the current, the heads of islands, masses of fixed drift wood, and the shores, in many places, were covered with them, tainting the air in the vicinity with putrid effluvia. The cause of the disease amongst the shelly race, remains as much a mystery, as that of the Asiatic cholera amongst the human family. It might possibly have arisen from the slight change made in the quality of the water, from the addition of marine salt, from the numerous salt furnaces now in operation along the borders of the river, the bittern of which, and more or less of the salt water, is daily mingling with the stream. Even a slight change in their vital element, might produce disease and death amongst molluscous animals; as in the atmosphere, fatal diseases fall upon man, from trifling contaminations.

Marietta, Jan. 2, 1837.

ART. X.—*Remarks on some of the Gold Mines, and on parts of the Gold Region of Virginia, founded on personal observations, made in the months of August and September*, 1836; by B. SILLIMAN.

As these remarks cannot lay claim to the character of a general summary, (since they were founded on local, although somewhat numerous observations,) perhaps there can be no better course, than to give an abstract of some of the most important reports that were made on the occasion, to different mining companies.

To those who are anxious to be correctly informed, this procedure will afford a fair view of facts, as they were presented to the eye of an actual observer and enquirer; while reference for more general views may be had to the Report of the Geological Reconnaissance of the State of Virginia, by Prof. William B. Rogers, and to the more detailed account which may be given by that gentleman, when his geological survey shall have been finished.

Some details of topography and of machinery, and other local facts, are preserved in these reports, because—although they may

not interest the general reader—they will serve to give a more precise idea of the actual condition and value of some of these mines, and of the promise they afford of being pursued with advantage.

Moss and Busby's Mines, in Goochland County, belonging to the Richmond Mining Company.*

The gold in the above named mines is contained in quartz. In this respect, with a single exception, they resemble all the other gold mines which I have seen in the gold region of Virginia, where the gold is in place. The rocks in which the quartz is imbedded are decidedly primary, and belong to the slaty family. Those which I have seen are generally varieties of mica slate, passing occasionally into argillite and the subordinate varieties of chlorite slate, talcose slate, hornblende slate, &c. Among these, as far as I have observed, mica slate is most predominant; and much that is here usually called talcose slate, appears to me to be mica slate. It is indeed often shining and smooth in its scales, but it wants the soapy feel that distinguishes talcose slate. The gold is therefore (as far as I have seen) to be referred, primarily, to the mica slate formation. The usual schistose or slaty structure and stratified arrangement of this rock, are here conspicuous. As is commonly the fact elsewhere, its position is inclined—frequently at a high angle with the horizon; forty five degrees, and more or less in different places. The rock is, in general, partially decomposed; almost always it is shivered and crumbly, and often to such a degree as to form earthy banks—soil above—clay farther down, and still lower exhibiting the lines of stratification and structure belonging to the original rock, but so soft as to be easily picked to pieces or cut.

The quartz in which the gold is contained is, in this region, usually spoken of as being in veins. It is perhaps not expedient to object to language that is in general use. It may, however, be proper to remark, that, in strictness, veins intersect and cross the strata at various angles; most metals are found in that situation, engaged in some material different from the rock; this material is called the matrix or gangue of the metal, and it is usually more or less crystalline in its structure, frequently affording the beautiful crystals that adorn the cabinets of mineralogy, such as rock crystal, fluor spar, calcareous spar, sulphate of barytes, &c.

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* About fifty miles from Richmond and from Fredericksburgh.

Since my observations were made, I have seen, *for the first time*, the remarks of Professor Rogers on this point; he regards these as true veins of injection; his observations having been more extensive than mine, it is certainly possible I may be in an error; I can speak only from what I have seen. The auriferous or gold-bearing quartz of the gold region of Virginia (and, as far as I am informed, of the States farther south) forms, not strictly veins, but rather beds or layers—in general not interfering with, but conforming to, the regular structure of the slaty rocks of the country, and like them, descending to an unknown and probably an unfathomable depth. There is therefore no probability that the quartz will ever be worked out to the bottom or exhausted, or that it will often be found heaved or displaced by fractures and dislocations, usually called faults, except so far as this accident may have befallen the rocks themselves. This structure makes the working of these mines very simple; the miner follows, unerringly, the bed or layer of quartz; it is rarely diminished to strings or disappears, and when that is the fact, it often reappears at no great distance, in an enlarged size. The quartz is, therefore, as regular a part of the structure of the country as the slaty rocks themselves, and when it is auriferous, (as is not unfrequently the fact in the gold region,) the gold is disseminated through it in spangles, flakes and points, sometimes visible on breaking the quartz, but most usually entirely invisible, even with a powerful magnifying glass. In far the greater number of cases, the eye detects nothing but quartz, or sometimes metallic sulphurets of iron, zinc or lead; and the observer, unless previously instructed in the case, would never suspect the presence of gold, either distinct, or in the metallic sulphurets. The gold, being generally disseminated in the quartz of this gold region, it is obvious that it must have been laid by in its stony bed, at the same time that the quartz and the slaty rocks in which it is contained were deposited. This fact increases the probability that the gold will not be exhausted; no one can indeed predict with certainty, to what depth it descends or in what proportion it exists below; but no reason can be assigned, why it should cease or be found in less abundance than near the surface. The same causes would appear to have been in operation—at the same geological epoch, from the Gulf of Mexico, through the gold region, quite to Maryland—perhaps quite to Lower Canada, and possibly still farther, as some facts would appear to indicate. Gold has been found in Vermont, Massachusetts, and Lower Canada, and, *as is reported*, in New York, New Jersey, Pennsylvania, and Maryland.

The nature of this report precludes discussions of geological theory, and the omission is of the less importance, because the origin of metallic veins and deposits is still, to a degree, obscure, and the clear light which now illuminates most topics of geology, is here, to a degree, wanting; nor would it be pertinent or profitable to recite the various hypotheses that have been, or are still entertained. It is however worthy of remark, that whether the quartz veins are, as Prof. Rogers supposes, true veins of injection, or original members of the rock, the probability of their continuance, and of their continuing to be auriferous, is equally great.

The mines now under consideration, belong to what are called the vein mines, in contradistinction from the deposit mines. The latter contain only alluvial gold, or gold, at least, disengaged from rock or vein stones; it is obviously not in its original connexion; it has, doubtless, proceeded from the destruction of regular veins or beds, and of the rocks which contained them; the gold has either remained mixed with the ruins of the rocks and the veins, or it has been transported and scattered, sometimes far and wide, by the moving power of water, and buried at depths more or less considerable, in loose materials. Sometimes the gold is found immediately under the turf or soil; this happens, most frequently, on hills, but more commonly it lies in lower situations under several feet, or even yards of soil, clay and gravel, and it is most abundant next to the slate, which underlies the whole of the loose materials, and which slate is sometimes soft, being in a state of decomposition. Where the slate rocks are solid, and their strata stand nearly perpendicular, the gold has been sometimes found in the crevices between the natural layers of rock; at the Whitehall mines, in Spotsylvania County, the gold extended downward in this manner, sometimes to the depth of three feet. It should be remarked, that in the regular vein mines, the gold is not confined entirely to the solid quartz; it is sometimes found in the slate, and both the rock itself and the soft matters proceeding from its decomposition, are occasionally washed for gold, with advantage.

The largest masses of gold have been discovered in or near rivulets, or brooks, or runs of water, called in the language of the country, branches. In such situations, pieces have been found weighing several ounces, and in North Carolina several pounds. On a branch at the Whitehall mine, gold of the value of $10,000 was found in the course of a few days, in a space about twenty feet square, and $7,000 value of gold was found at Tinder's mine, in

Louisa County, in the course of one week. It happens not unfrequently, that the vein mines are discovered in consequence of washing the earth, particularly in the branches.

Busby's Mine.—This mine is wrought in solid quartz. A shaft has been sunk to the depth of fifty seven feet, and it is intended to sink it to seventy feet, until it strikes the vein at this depth; this vein is the first or the most easterly in the series. The thickness of the quartz, as ascertained by excavating it between the strata of rock in four proof pits, which have been sunk to the depth of from twenty to twenty six feet, averaging twenty two feet, is from twelve to thirty inches, averaging from fifteen to eighteen inches. In consequence of the influx of water, it has become necessary to erect a steam engine at the shaft; the machinery is now at the place, protected by a good framed engine-house, and will be soon in operation; this, it is expected, will effectually drain, not only the shaft and the vein to which it leads, but the other veins also, which have been already excavated, and will moreover serve to work the mills. The whim* at the shaft and all the machinery connected with it, are well sheltered by a good framed building. There are also temporary log tenements for the accommodation of the superintendant and his assistants and laborers, and there are abundant materials at hand for the erection of other buildings whenever they shall be needed. The quartz in Busby's mine is very firm—its structure is coarsely granular, and it considerably resembles coarse loaf sugar; indeed, at the mine, it has been significantly called sugar quartz; much of it is, apparently, free from all foreign matter, except the inherent gold, and it is so white that even when pulverized, it shows no tint of color.

The quartz, with its included gold, is, at the mines, universally called ore. Strictly, the word ore should be applied only to *the metal* of beds and veins, and especially to those combinations of metals with other substances, e. g. with sulphur, oxygen, &c., by which their properties are more or less disguised; and it is a liberty of speech, to make it include also, the stony matrix or gangue which encloses the metallic substances that form the proper ores. From necessity I shall adopt the language now in general use in the gold region, and I will, therefore, in compliance with general custom, call the auriferous quartz, *ore of gold.*

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* A technical name for the machine that winds the rope.

In general, the auriferous quartz or gold ore of Busby's mine is destitute of any metallic appearance, the pieces which, on fracture, present metallic gold, being but a very small part of the whole. Hence the surprise and delight of the spectator are very much increased, when he sees the precious metal evolved by very simple processes. I would here observe, that to obtain this, (the only decisive result,) all necessary precautions were, during my investigations, adopted to prevent error. Imposition is, indeed, spoken of, and is said to have been practised in some cases. It is however but justice to the respectable gentlemen and master miners, with whom I was conversant in all these trials, to say, that their conduct appeared to me uniformly upright and honorable, and I believe there was neither disposition nor opportunity for fraudulent practices. There is no reason whatever to doubt that the results, about to be stated in the case of both the mines, were correct; if there were any error, it was in stating the gold too low, as it is certain, that after every precaution, some of it was lost in the washing; still, it is not to be expected that a more favorable result will be obtained in the large way, even supposing that the quartz should, in the progress of working the mines, continue equally rich in gold, as the pieces that were tried; and for practical purposes (aside from science) it is always desirable that trial-processes should, in their results, as nearly as possible, resemble those that may be actually used in the large way.

The quantity of ore which has been accumulated at the Busby mine, and which now waits for the final operations for extracting the gold, was estimated by the underground captain of the mines, at twelve or thirteen thousand bushels. From a large heap, some pieces of quartz were taken at random. They were carefully examined by a good magnifier, and not a particle of gold or of any other substance, except the quartz, could be discerned. Portions were knocked off from each, and were pulverized and sifted. Of this powdered quartz, in which, during the pounding, only a few points of metallic gold became visible, six pounds were taken and washed in an iron pan in the usual way; the matters that were carried into the tub, (used as a recipient,) were washed several times, and gold, although in decreased quantities, was, in every instance, obtained from them: all these portions of gold were then amalgamated with mercury, which had been strained through leather; the amalgam was strained through silk to separate the excess of mercury, and the globule of amalgam that remained was then decomposed by heating it in a clean

iron pan, until the quicksilver was all expelled. The gold that remained weighed six grains, which is in the proportion of one hundred grains to one hundred pounds, or one bushel of the ore. These one hundred grains of gold, at $4\frac{1}{12}$ cents per grain, the price paid at the United States' Mint, amount to $4.08 for the one hundred pounds of ore. In a second trial, pieces of quartz were taken, which presented some points of metallic gold to the naked eye; they were not very numerous; and still, pieces were selected which were about as good in visible metallic gold as could be readily found. Two pounds of the powder of this ore, treated in precisely the same manner, yielded six grains of gold; this, being exactly three times as much as in the former trial, gave $12.25 to one hundred pounds, or one bushel of the ore. Perhaps it is not to be supposed that the mere accident of gold being visible would, of course, indicate so rich a result; and on the other hand, the mere fact that the gold is invisible, does not, of course, imply that the yield will be as low as, or lower, than that obtained in the first trial. The average of these two trials gives $8.16 for one hundred pounds, or one bushel. It is probable that this result is too high for a general average; even half this amount would be very rich, and a quarter of it would be very safe, supposing the expenses of working the mines to be no greater than they have been generally stated to be.

It is worthy of remark, that, by report, the earth around the Busby mine yields, generally, more or less of gold by washing; and I saw this statement repeatedly confirmed by experiments made under my own eye, upon the loose earth thrown out from the pits; it was understood to be that in which the quartz veins were imbedded in the ground, and had doubtless proceeded from the decomposition of the slaty rocks.

Indeed, through the whole of the gold region, I was assured that the loose materials of the surface are generally so far auriferous, that visible gold can, in many cases, perhaps generally, be extracted by simple washing. With a small iron pan, they wash the earth in a tub, or in some brook or branch of water, and many persons in the gold region have acquired the necessary tact. They call the operation panning, and the soil, gravel, &c. is said *to pan well* or *to pan poorly*, according to the result.

Moss' Mine.—This mine is three quarters of a mile from Busby's, and both mines are about fifty miles from Richmond and fifty three from Fredericksburg. Moss' mine is situated in decomposed slaty

rock, the same which, in a greater or less degree, pervades the gold region. Here, in the portions nearest to the surface, the rock is completely destroyed, and is little else than a red clay ;* lower down, it becomes somewhat firmer, and shews, distinctly, the lines of stratification and of the slaty structure. The inclination of the rock and of the included quartz veins is about forty five degrees; the direction by compass, is about N. by E. and S. by W. The diameter of the vein, which is at present wrought is, taking it at different places, sixteen, eighteen, twenty four, twenty seven and thirty inches, averaging about twenty four inches. The structure of the quartz vein is distinctly laminar; it divides easily into tabular portions, from half an inch, to four or five inches in thickness, and these pieces have cross divisions. Hence, the quartz is broken up with great ease, especially as there is no adherence of the quartz to the slate, and therefore blasting is not needed, nor are any instruments requisite except simple picks and crows, and other common tools. The mine is, at present, approached by a single inclined plane or covered way thirty one feet long in the slant, and twenty five feet deep in the perpendicular. There is another and a parallel shaft fifty feet deep, but now filled in the lower twenty feet, by earth washed in by recent rains. There is an adit connecting the two shafts which slant in the direction of the vein; the adit is seventy feet long, in the entire length, and the vein is exposed through this whole extent. I had full opportunity to examine the vein at the bottom of the mine, and it is impossible that one should be found more accessible or more easily wrought. With a view to a careful examination of the proportion of gold, I caused pieces of the vein to be knocked off in several places, at distances of twelve feet. From each of these pieces, portions were broken, and being carefully examined with a magnifier, no traces of gold could be any where perceived. They were then pounded and sifted, as in the case of the Busby mine; nine pounds were washed, and the gold was amalgamated and the amalgam decomposed by heat, precisely as in the former case.

From the nine pounds of ore, a button of gold was obtained weighing eleven grains, which is in the proportion of one hundred

* From which, by washing and subsidence, a good and very useful paint might probably be prepared—admitting of various shades by the application of heat—forming a strong color for coarse work, and an elegant one, if covered by copal varnish.

and twenty two grains for every one hundred pounds, or one bushel. This, at $4\frac{1}{2}$ cents for each grain of gold as before stated, gives $4 98 for one hundred pounds of the ore.

In another trial, three and a half pounds of the powdered ore in which no gold was visible, yielded six grains of gold, or one hundred and seventy one grains for one hundred pounds, equal in value to $6 98.

A third experiment on ore in which gold was not visible, produced five grains from two pounds, equal to two hundred and fifty grains from one hundred pounds, and worth $10 21 to one hundred pounds of ore. The average of the three trials upon the ore of Moss' mine is $7 39 to the one hundred pounds of ore; and the average of the five trials made in the two mines is $7 70. I am assured that when a mine yields one dollar to every one hundred pounds of the ore, (as the cost of working is stated to be about one third of this sum,) such a mine is regarded as profitable, and as justifying heavy expenditures in machinery and in operations of deep mining. At the Walton mine which I visited and examined, the average yield has been, as stated to me by the manager, $5 92* to the one hundred pounds of ore; and two skillful gentlemen obtained from one of that mine between twelve and thirteen dollars to the one hundred pounds, being about the maximum obtained by me from the ore of the Busby mine.

I forbear to quote instances of a much larger product, stated to me as having been obtained from the Busby mine, because the result was procured by an officer of the mines, although I have no reason to question either his integrity or his skill. The average product at Fisher's or Hughes' mine, as stated to me at the mine by Mr. Fisher, is $3 15* for every one hundred pounds of the ore, and I infer from his statements of expenditure, that the cost is not over thirty to thirty five cents for every one hundred pounds. Comparisons cannot be made with accuracy between deposit mines and vein mines, because the expenses of working are so widely different. It may not, however, be useless to state, that at the Whitehall deposit mine, where twenty seven hands are employed, the work is profitably carried on, with twenty dollars of gold obtained at present, in a day, and it is said that two cents on a bushel would yield a good return. Being dependent entirely upon information obtained since I came into the

* And now mentioned by permission. I afterwards examined the Walton mine at another visit, and the report is annexed.

gold region, as to the expense of working the mines, I give on this head merely the reports of others, but, I would suggest that the expense must, of course, increase as the mines are sunk deeper. It is true that experience in management and improvement in machinery, operations, and processes, will tend to diminish expense, and increase the product; but the ore may not continue equally rich, and on the other hand it may grow richer; this is, both ways, uncertain, and as no human science or skill can remove this ambiguity, it follows that mining enterprises cannot be relieved from this hazard. It is, however, wise to make estimates of expenses high, and of receipts reasonably low, that the chances of disappointment may be, as far as possible, provided against. Should the trials made by me, and under my direction prove, in the event, to be a fair representation of the average produce of the mines of Busby and Moss, (provided also, that the expenses have been correctly reported,) it follows of course, that the profits must be great. Prudence would suggest, however, that the estimate should be made at a lower rate than that which I have reported; if it were taken at one half of what was actually obtained, the yield would exceed that at Fisher's mine, which is understood to be a very profitable one; and if it were estimated even at one quarter, and the expenses are no greater than have been reported, the enterprise could still be profitably sustained, unless the interest of capital should cast the balance the other way.

With respect to the sums paid for the mines, I am not called upon to speak, nor would it be proper that I should express any opinion. I would simply remark that, in my judgment, nothing could be more inauspicious to the mining interest and to the welfare of the country, than a spirit of speculation in these concerns. In an excited state of the public mind, it is rare that facts are correctly reported, or correctly viewed. The speculator, who buys merely that he may sell again, is, too frequently, ignorant of the facts, and reckless also of the consequence in regard to those who may succeed him in his obligations; flattering gains from sales of stock are reported from day to day; the property rapidly changes hands; the public mind being morbidly excited, is of course blinded, and at no distant period, accumulated ruin falls heavily upon the last in the train. This is exactly the opposite of that mental sobriety and moral rectitude which ought to govern men in all concerns, and especially in such transactions as these; it is not too much to say, that no man should either

buy or sell a mining interest, unless he can, in honor and conscience, declare that he believes it can be profitably carried on.

So far as I have had opportunity to observe the gold mining region of Virginia, I am convinced, that in several places (and it is probable their number will be increased) the explorations may be prosecuted with advantage, while in other cases they will prove losing concerns. The small proprietors of land should not be encouraged to abandon their regular industry for gold hunting, and even when capitalists associate for these objects, (which is certainly the more proper course,) prudent men will be slow to pledge more than they can lose without embarrassment, certainly without ruin.

In recurring again to the mines of Busby and Moss, I have to remark that the land, (consisting as I am informed, of one hundred and eighty three acres—fifty three to Busby's, and one hundred and thirty to Moss', lying in tracts nearly contiguous,) is well wooded with valuable timber, and well watered for the purposes of mining or of agriculture. The soil is thin, like most of that in the gold region; but the physical features of the country are favorable to mining operations, the surface being formed in gentle swells; and good roads may be constructed at a moderate expense. At Moss' mine, about one thousand bushels of ore have been raised. It is due to the gentlemen charged with the management of these mines to say, that I have been most favorably impressed by their intelligence, zeal, and candor; and I with pleasure acknowledge my obligations to them for their uniform kindness, and judicious and useful co-operation during this investigation.

I am not willing to omit a deserved commendation to the master miners, both here, and at several other mines which I have visited; comparing them with persons of their profession with whom I was formerly conversant, in some of the most important mining districts of England, I am justified in saying that they appear deserving of confidence.

Mr. Forrest Shepherd, a gentleman who has had much acquaintance with the gold mines of Virginia, being present at the examination whose result is given above, and being requested by me to aid in the processes, states in a published letter, that at Moss' vein he saw the ore broken from the rock—that he counted every fragment, and broke portions in numerous places from these same fragments in order to obtain a fair average. This ore, he states, was pounded

under his eye, and a part of it weighed by his own hands, and that the results given above, he believes to have been in all respects correct, both with regard to the veins and the gold obtained from them.

The Walton Mine, in Louisa County, forty miles S. W. of Fredericksburgh, and belonging to the Walton Mining Company.

The tract of land in which this mine is situated, contains one hundred and four acres. The surface is formed in fine swells and depressions, presenting hills, bounded by large curves, and vallies of similar shape. The soil is considered as good for agriculture; much better than the average of land in the gold region. There are several good springs of water, and several branches or rivulets quite sufficient for the washing of gold, but not sufficiently copious for driving powerful machinery. The land is clothed mainly with forest; the principal kinds of trees are oak of several varieties, pine, hickory, and maple: a good proportion of the trees are large, and well fitted for building or machinery, while the rest of the growth is good for fuel and other ordinary purposes. There are *passable* roads, communicating with the tract in every direction: some of them are good, and all are capable of being made so with moderate expense.

The geological structure is similar to that which pervades the gold region of Virginia generally, as far as I have seen it. In this region also slaty rocks form the basis of the country; their strata are highly inclined: they are not however placed on their edges, as in some parts of the gold country, nor dropped down to a position approaching the horizontal, as in other parts. At the place where the mine is opened, the strata form an angle of about thirty five degrees with the perpendicular, and their bearing, by compass, is considerably to the east of north. Several veins of quartz accompany the strata of slate, it is presûmed quite through the territory. This is known to be the fact with the vein that is wrought, and it cannot be reasonably doubted that this is the fact also with all the others, whose *knobs*, evidently *in place*, and whose scattered ruins appear here and there above ground, although generally covered by forest, by soil, and by vegetable deposits. These veins are distinctly traced in the tract south, and it is believed, also, in that north; so that the land is fully and distinctly marked by the characteristic features of the gold region. There are also rich deposits and veins of gold in its immedi-

ate vicinity, as appears from the following facts, communicated to me by persons of good information, although not by the parties themselves.

Tinder's mine lies about two miles northeast from that of Walton. It has been explored, chiefly by surface diggings, and washings of the gravel, &c. The excavations of the surface are numerous and extensive, and within four or five years they have obtained forty thousand dollars, about seven thousand dollars of which was from a single depot. A tract belonging to Jenkins and others, lies between Walton's and Tinder's, and also immediately beyond the latter; from the Jenkins tract, by working in a careful and economical way, they obtain from two to three thousand dollars per annum, and Jenkins is in the habit of substituting a fall-working in the gold, for which he obtains one thousand dollars annually, as a compensation for his tobacco crop, which he relinquishes in favor of the gold. Within a few days, they have discovered on Jenkins' land, a vein of quartz, which is very rich in gold. A good observer, a master miner, informed me, that he saw in this vein of quartz, pieces of gold projecting from it, as large as the first joint of a finger. In consequence of this discovery, so much curiosity and cupidity have been excited, that they have been compelled to inundate the vein, until measures can be adopted for its adequate protection. At Boxley's, near Tinder's, they obtained, the first year, nine thousand dollars, and have probably accumulated twice that amount of gold in the whole. At Baker's, near Walton's, they gathered, with their own people, about five or six hundred dollars in one year. At William Goodwin's, a little south of the Walton Mine, they procured, with their own hands, about one thousand dollars, and at Childs', one mile and a half southwest, they got three hundred pennyweights. Thus it appears that there is much gold in the immediate neighborhood of the Walton Mine; there are also many places not named above, and not far off, where gold has been obtained by washing; and measures, as I am informed, are about being taken, to open some other places in this region, more effectually.

These facts are of great value, as indicating that the tract now under consideration must also be auriferous, and were its real character in this respect unknown, we could scarcely doubt that it must resemble its neighbors. But we are not left to conjecture. Four years have now elapsed since diggings and washings for surface gold were commenced here upon three branches, (small streams,) and the

precious metal, being discovered in all these situations, as well as in various other places upon the land, the explorations were, for some time prosecuted with considerable energy, as may be inferred from the diggings in many places, and more especially from the great piles of gravel now lying near the principal branch. They remain still, to a great extent unwashed, and it is believed they would pay well, if subjected throughout, as portions of them have already been, to the rocker and to amalgamation. This will probably be done at some future period of more leisure and convenience. That it has not been already done, must doubtless be attributed to the discovery very soon after the surface gold had been found, of the rich vein of auriferous quartz, which, with its contents, will now claim our attention.

This vein has the same bearing and inclination as those already described in connection with the slaty rocks, between which it lies. The vein is over one foot in thickness. The quartz is, in general, firm and compact; occasionally it is porous and interspersed with iron pyrites and a dark iron ore, probably proceeding from their decomposition. The slaty rock is much decomposed—or as it is termed by the miners—*it is rotten:* it is therefore, at least in the upper strata, easily broken or cut by tools; it, as well as the quartz of the vein, is much stained by iron, and both are, to a degree, mixed in the heaps of ore. In the more profound depths of the mines, it is to be expected that the rocks will be found firm, and that they will require, (as in many mines of the gold region they now do,) blasting by gun-powder. As in penetrating into the earth we recede from the influence of the atmosphere and of the weather, we are to expect that both the vein of quartz and its rocky walls will oppose more resistance to the miner than they do near the surface. The vein of quartz which has been worked in this mine, has been penetrated by two shafts, one seventy and one forty feet deep: they are connected by two parallel adits—one of which is at the depth of forty feet and the other of seventy; the shafts are one hundred and five feet apart, but the adits are one hundred and ten feet long. The flow of water into these excavations is so considerable, that a feeble horse power, which is at present applied by buckets connected with the horizontally revolving machine, called a whim, is quite insufficient to keep the shafts and adits clear. The ore is therefore not at this time raised from the mine, nor is it now possible to descend into the adits, without several days of previous labor in raising the water.

As regards a satisfactory examination of the true nature of the mine and of the ore which it yields, this is, however, of no importance; for there is already above ground a very large quantity of ore obtained both from the shafts and adits, giving full information of the productiveness of the vein and of the quality of the ore. From the regularity, the thickness, and the great extent of the vein, there can be no reasonable doubt that it will continue for a long time to afford an abundant produce, nor can any reason be assigned why the richness of the ore should be diminished. This is indeed a point upon which human sagacity cannot give us absolute assurance, and it must always be remembered that mining operations invariably involve a degree of uncertainty, because we cannot see what is below, until our operations have penetrated to those dark recesses and brought to light their hidden treasures. A favorable presumption is, however, as well sustained in this case as it can be in any, and we therefore proceed to the very important and responsible duty of ascertaining the proportion of gold, which the ore hitherto raised will yield. For this purpose four trials were made. 1. A trial was made upon ore, believed to be as poor in gold as any average which the mine has hitherto yielded. 2. It was made upon ore supposed fairly to represent the average richness of that hitherto raised. 3. It was made upon ore taken at random, without any reference to its being either rich or poor. 4. And finally, upon selected pieces, showing gold to the eye, and supposed to be rich.

1. The first trial was made upon a portion of ore, which, last year, was prepared on a considerable scale for an average trial. It was deemed proper to re-examine that result, as the conclusion drawn from it was highly important, and had deservedly produced a decisive impression upon the opinion entertained of the value of the mine. On that occasion, ninety-two bushels of the ore, taken promiscuously, were roasted, ground, washed and amalgamated. More than five hundred dollars were obtained as the result, and the average yield was $5 92 for one bushel, or one hundred pounds of ore. These facts are given on the statement of the individuals concerned in the experiment, one of whom is still at the mine. Several bushels of the prepared ore then used are also still there. From this residuum six pounds were taken—but there was this important difference in the trial—all the visible gold had been carefully picked out during the pounding, sifting, and other preliminary operations, and the material now used contained apparently no gold, and looked

indeed like a mere mass of Spanish brown, prepared for painting; the color was darker than that of the pulverized ore generally, because it had been operated upon by fire. The six pounds of this material were then washed—the gold, now become visible, was amalgamated, and when the mercury was expelled by heat, there remained five grains of gold, being in the proportion of eighty-three grains to one hundred pounds, or one bushel of ore, and having, at $4\frac{1}{12}$ cents a grain, the mint price, the value of $3 39 for one hundred pounds.

Considering that in the trial made in the large experiment before cited, all the gold was in the ore, and that in this trial all that was visible had been picked out—considering also that in this smaller trial the proportionate waste of gold in washing was greater than in the larger, it would appear that the conclusion stated, from the examination of the ninety-two bushels, was sufficiently sustained. Under all the circumstances which have been stated, the trial now made upon the six pounds of the residuum of the great experiment, may be fairly regarded as standing for the poorer sort of ore; this will more fully appear by comparison with the other trials that are now to be stated.

2. In addition to the large mass of ore more or less mixed with the slate, and now lying at the mouths of the shafts, there is in the ore-house, a pile, supposed to contain from twelve to fourteen hundred bushels, upon portions of which the remaining trials were made. The condition of this ore is as follows: The firm masses of quartz, from the size of a hen's egg to that of a man's fist or of a human head, are mixed with smaller fragments, and with the mere ruins both of the quartz and the slate, more or less pulverized, and much of it is in the condition of powder, or of the fineness of common dirt or soil. This rude heap is, to the eye, quite uninviting; it looks like a pile of yellow ochre, mixed with dirty quartz stones, and were an uninstructed observer to be assured that it contains a great treasure, even at the lowest estimate, many thousand dollars, or possibly many thousand guineas, he would consider the speaker as trifling with his understanding. Still, although the heap exhibits to the eye, no appearance of any metal whatever, except iron rust, it is, without doubt, as will now appear, a treasure of great value.

By my direction, a hole was dug deep into the pile, and the materials being taken up with a shovel, promiscuously, just as they came, a sufficient quantity of both large and small was pulverized

and sifted. Of this, six pounds were taken and washed in the usual way; the gold which now appeared in decisive quantity, where none was before visible, being amalgamated, and the amalgam strained and decomposed by fire, amounted to twelve grains for the six pounds of ore; this, being in the proportion of two hundred grains to one hundred pounds, equals $8 16 for that amount of ore. This trial would appear to be as fair a one for the ore-heap as could well be made with the same weight of the materials.

It may be important to observe, that in a visit to this mine two weeks before, although not then *authorized* to examine it *responsibly*, I was desired by Dr. Benjamin Coleman, agent for the Richmond Mining Company, and at that time with me, to pay some attention to this mine, that I might be the better able to judge of the mines in Goochland county, which I was soon to visit, and of which an account is contained in the preceding pages. I did, accordingly, then examine the condition of the ore of the Walton Mine, so far as to cause portions to be pulverized and washed from various parts, inside and outside of this ore-heap, and there was, in every instance, a yield of gold so striking to the eye, that had the amalgamation and extraction been finished in the way above described, I cannot doubt that the result would have been substantially the same with that now obtained. These facts, taken in connexion, leave then no doubt as to the average richness of this pile of ore, and of course of the vein from which it is derived.

3. The third trial was made upon pieces of solid quartz, taken at random from the heap of ore; no gold was observed upon them, but on being pulverized and washed, the powder showed gold richly, for when the usual process by amalgamation and evaporation was finished, six pounds of the material yielded thirty grains of gold, answering to five hundred grains, and equivalent to $20 41 for one hundred pounds, or one bushel.

4. The fourth and last trial was made upon pieces of the quartz, selected on account of their showing gold to the naked eye: no pieces were admitted which did not exhibit one point or more of gold; few showed more than two points, and generally they were not larger than the head of a common pin. Of this lot of ore when pulverized, four pounds were taken and washed and amalgamated; the product of gold was one hundred and thirty-one grains, in the ratio of thirteen hundred and ten grains for one hundred pounds, and equivalent in value to $133 73.

The product of the four trials was—

1.	For one hundred pounds, ...	$3 39
2.	" " "	8 16
3.	" " "	20 41
4.	" " "	133 73
		$165 69

Division by four gives the average $41 42 for one hundred pounds.

This result, startling as it is from its magnitude, is, I am certain, below the truth, because some of the gold was lost in the washings. That there was no imposition is equally certain. I went with the master miners to the ore-house the moment of my arrival: the processes were, from beginning to end, conducted under my constant inspection and that of two confidential companions, and during this time the ore-house, including every thing relating to the processes, was double-locked whenever I left it, and the keys were always about my person until we resumed our work, nor did I ever, at any moment, leave the premises while they were open.

It may be added also, that the character of the master miners places them above all suspicion, and neither they nor any one concerned in assisting in the labor, had the smallest interest in the result.

I can truly say, that I could have wished the product had been less rather than more, for I greatly fear the effect on the community of the golden dreams which it may produce, and therefore repeat the cautions already thrown out. I would suggest, that an average much lower than that actually obtained, should be the one adopted, to be acted upon. It would certainly be wise to throw the fourth trial aside, as one which, although it may be sometimes exceeded at this mine, (which I am informed has been the fact,) may not often be attained, and never except upon selected or accidental specimens. The three first trials would appear to give results such as may often be looked for; their average is $10 32 to the one hundred pounds of ore, but it would probably be unwise to form any important arrangements even upon this result. It is, I suppose, certain, that one far below this, even as low as that obtained in the first trial, would form a very safe basis of proceeding, granting that speculation has not enormously enhanced the price of the stock. As to this, as I can form no calculations whatever, I wish distinctly to disclaim any re-

sponsibility for its results. My duty is performed, in all the cases in which I have been charged with inquiries concerning the gold mines of Virginia, when I have correctly and faithfully reported their actual condition, and the produce in gold of those portions of the ore which I have examined. That the Walton Gold Mine and many others in Virginia may be profitably wrought, admits of no doubt—provided, that in all cases, good judgment, sound economy, competent skill, adequate machinery, and strict fidelity, combine their salutary influence; otherwise, the result may be calamitous, and the discovery of the precious metal in Virginia may prove a curse, instead of a blessing. There can, however, be no reason for believing that these interests will be abandoned. They will be pursued with sobriety, and in many instances with success. The enterprises are still in their infancy; experience will, in this case, as in other cases, prove the best instructress; in all probability, many rich gold deposits and gold veins remain to be discovered both in Virginia and in other States, and our country may confidently expect from its own territory, here and elsewhere, sufficient supplies of gold for its coinage, for the demands of the arts, of ornament, and of use, and not improbably for exportation.

Prof. Rogers, of the University of Virginia, inspected this mine in April, 1836, in company with Mr. Forrest Shepherd: they give the following results.

1. In the lower adit leading from the main shaft, which was examined throughout, the auriferous vein of quartz rock presented a very uniform thickness, varying from a little more to a little less than twelve inches in width.

2. The talcose rock, underlying the vein, is also auriferous to a distance of six inches, and sometimes more, from the quartz.

Prof. Rogers was strongly impressed with the continued yield of gold obtained from the quartz, by pulverizing and washing, and by the uniform dissemination of the gold throughout the quartz, and the lower enclosing rock. From forty seven pounds of the ore 6.5 pennyweights of gold were obtained by amalgamation and evaporation of the quicksilver, giving nearly 14 pennyweights to the one hundred pounds; a result which coincides remarkably with some of those obtained by me.

Mr. Shepherd remarks, that by diligent search, no gold of any importance has been found either eastward or westward of Walton's tract.

The Culpeper Mine, belonging to the Culpeper Mining Company.

The mine is situated eighteen miles west of Fredericksburgh, upon the river Rapidan, a few miles above its confluence with the Rappahannock. The tract is stated to contain five hundred and twenty four acres, of which about two hundred are in forest; a fair proportion of the woodland is covered by pine and oak trees, of large size, and excellent quality; the oak affords timber of the best kind for machinery, and the pine, (chiefly of the red heart kind—most of it being heart,) is admirably fitted for the construction of the buildings. This species of pine is understood to be confined to a small portion of country. The rest of the forest-growth is fitted for fuel and other common purposes.

The soil of the tract, like that prevailing, generally, through the gold region of Virginia, is thin.

The surface is varied; the portion nearest to the great public road, leading to Culpeper Court House, is nearly level: that upon and near to the river is formed in fine undulations, with hills which rise one hundred and thirty feet above the Rapidan, and afford great facilities for mining. These hills are similar to others on the opposite side of the river; and they, with the intervening vallies—the woodlands—the cultivated fields and the stream, form striking features in a varied and beautiful landscape. While the river Rapidan affords most abundant hydraulic power, for mills of every description, and washes the entire boundary line of the tract on one side—a considerable rivulet or branch called Patrick's Run, passes through the land, furnishing every facility for washing the ore, and even considerable resource for machinery.

The buildings, of every description, are of a better construction than are generally found at the gold mines; with scarcely an exception, they are framed substantially, and clap-boarded; there are houses for the miners and laborers, besides inferior cabins: there is a good blacksmith's shop and store-room adjoining; an ore-house properly secured—a magazine for powder and other valuable things, situated on a high point, at once conspicuous and completely detached, and in all the arrangements, attention has evidently been paid to the morals and decent manners, as well as to the comfort of the people. There are two ore-yards faced with substantial stone walls, and properly levelled: they are, of course, contiguous to the principal adits or mouths of the mine.

The hydraulic power, already mentioned, will soon be turned to great account, by the various constructions now in great forwardness. The entire river Rapidan, here about three hundred feet wide and three feet deep—is raised by a dam, now nearly finished, near the uppermost point of the tract of the Company. The dam is two hundred and twenty five feet long, besides the abutments, which are one hundred and sixty feet more, making four hundred and twelve feet. The height of the dam is in front nine feet—rising six feet above the water below; the water above the dam is eight feet deep, and below it is three feet.

The object of the dam is to turn the water into a canal which runs along the left bank of the river, for the distance of five thousand four hundred feet—over one mile. This canal, which is already to a great extent excavated, is from eighteen to twenty feet wide at top, and nine feet at bottom, and fitted for a depth of water of seven feet.

The river will be led into it, through a very strong gate-way, supported by a powerful frame-work.

The amount of water-power secured by this canal, is so great, that several mills, in addition to those now in construction, might be driven by it. A saw-mill for the purposes of the mine, is in the course of construction, above two-thirds of the way down the canal; it will be supplied by a lateral cut. The building is forty five feet by fourteen; it will contain one saw, which will cut one thousand five hundred feet of inch plank in a day.

The stamping and amalgamating mills, for which mainly the canal is excavated, are to be contained in a building sixty four feet by thirty, of very strong timber, thoroughly framed. It has a basement story of twelve feet high, substantially built of stone. The water wheel is sixteen feet by nine, and is undershot. It will carry twenty heavy stamps, for crushing the ore, and the number may be doubled. There is room and power enough for Chilian, Tyrolese and Araster mills, if the latter are desired; but, it is intended to annex the simple amalgamating bowls of Mr. Hitz, the skillful machinist, whose work in this mill does him great credit, both for its strength and ingenuity, and it is said that his amalgamating bowls are very effectual, while they are comparatively cheap and simple.

The mining operations are considerably advanced, and are conducted by Mr. Hitz, with regularity and skill. The elevation of the ground into hills, rising, as already stated, one hundred and thirty feet above the river, presents great advantages for drainage, and for

working the mines in other respects. There are various shafts formerly excavated by Hempstead and others—most of which, being neglected, have fallen in, or are in a state of dilapidation, so that they require no particular notice.

A capacious shaft is now in the course of being excavated, in the highest part of the hill nearest to the river. Its dimensions are ten feet by four, and its depth is, at present, fifty seven feet: it is sinking, at the rate of two feet a day, and it will continue to descend, until it meets the adits from the opposite sides of the hill entering at its base. The shaft will probably be one hundred and twenty feet deep. At the depth of forty feet, there is a tunnel, branching off on both sides, from the shaft; it is in the whole thirty five feet long, pursuing the course of the vein, which is from eight inches to twenty four, and even to thirty inches wide: the tunnel is timbered, as far as is necessary, and is six feet by two and a half in the clear. The shaft also is thoroughly timbered and planked, and furnished with a good ladder and a strong windlass, rope, and buckets, so as to afford all necessary security. The passage-way, in which the ladder is suspended, is partitioned off from the rest of the shaft. At the bottom of the shaft, the vein is from six to fifteen inches wide. In each of the two hills in which the mining operations are carried on, there are two adits. Beginning with the hill nearest to the river—at or near its base, and about twenty or twenty five feet above the level of the river, an adit has been opened into the hill, with the intention of communicating with the shaft already described. This adit is well timbered and planked, so as to be perfectly secure: the planks are two inches thick and the dimensions in the clear are six feet by two and a half; its length at present is one hundred and twenty three feet, and it is increasing at the rate of three feet per day—varying however with the hardness of the rock. There are two cross-cuts in the adit intended for exploration, and they serve also as a refuge for the miners, from the fragments thrown off in blasting: their length is fourteen feet for the one, and twenty eight for the other. The adit is floored with timber and plank, and there is a free passage under it of six inches deep or more, for the discharge of water and for ventilation: this purpose it answers extremely well—the current of air being so strong beneath the floor as to blow out a lighted candle, when placed at its mouth. This mode of ventilation is so effectual, that an adit can (in the opinion of Mr. Hitz,) be driven one thousand feet into a hill, without sinking a shaft to meet the

level. The adit, just described, is named No. 1, and, as already stated, will be driven in to meet the shaft.

The adit opposite to this, on the other side of the hill, is named No. 2, and is, in all respects, similar to No. 1—except that there is a deviation of the vein, nearly one hundred feet from the mouth of the adit, which causes an abrupt offset of seven feet to the left, where the vein is recovered. The entire length of this adit is, at present, one hundred and seventeen feet, and when finished, it will, like No. 1, strike the shaft common to the two adits, forming one continued communication, which will completely perforate the hill, and afford a passage through, from side to side. The vein in this adit is two and a half feet wide, measured in two places. In adit No. 1, the vein was less perfect, being divided into strings or ramifications. From No. 1, about four hundred bushels of ore had been taken. The ore at the shaft and at the other adits, was not estimated, but its quantity was very considerable. Adit No. 3, is carried into Hempstead's hill: its mouth is immediately opposite to that of adit No. 2, and it is separated from it only by a small branch of water: it is in fact a continuation of the two adits 1 and 2. No. 3 is, in form and cross dimensions, like the others; it is one hundred and fourteen feet long; it is very strongly timbered with oak posts and two inch plank. Adit No. 4, is on the southeast side of this hill, and its course is at right angles to No. 3: it enters at a lower level, probably twenty or twenty five below, and, like No. 3, is intended to strike Hempstead's old shaft on the top of this hill, and near its centre, which shaft may be opened again.

In addition to the adits already described, another has been opened, a little to the northwest of No. 3: it is called the dust-vein, as the ore is obtained from it in a powdered state, at least in part. This adit has been, as yet, driven only a few feet into the hill—but it discloses a vein about six feet wide, which is found to be rich in gold. This appears not to be the entire breadth of the vein: there is an additional mass of quartz in place, by the side of this adit, and not yet excavated, which is four feet wide—making a vein in the whole, (with the addition of the dust vein of which it appears to be a part,) ten feet wide. This vein is doubtless a distinct one from that in which adits No. 1 and 2 are excavated. Of these veins we are sure, and probably others will be hereafter disclosed. There can be no reasonable doubt, that the knobs and other fixed masses of quartz observed in numerous places, here and there, on the tract, are parts of

veins in place, and that the loose fragments of quartz which are scattered in profusion, upon various parts of the ground, are attributable to a similar origin.

The main vein, hitherto worked in this tract, appears, in some places, prone to divide into strings: sometimes several, perhaps not longer than a finger, proceed parallel, or nearly so, being separated only by portions of the slaty rock: their separation appears, in general, to be only temporary; for the greater part, they again converge, and unite in a main vein, and the gold is observed to be more abundant in these strings than in larger veins. There is much iron accompanying the ore of gold. It imparts a red color, more or less intense, and the pulverized quartz is almost always red or brown. There is here an iron ore regarded by some as a hydrated oxide. It appears to have proceeded from the decomposition of iron pyrites, which, in many places, are still found fresh and brilliant; in other instances, splitting, rusting, and undergoing decomposition, the result of which is, that a portion of this mineral passes off in the form of sulphate of iron or copperas, which water easily dissolves, while a large portion remains in the form of a vesicular and corroded dark brown or red oxide. So far as this ferruginous matter contains gold, it is doubtless derived from the iron pyrites, which appears to be more or less auriferous, and when it is decomposed, the gold, being insoluble either in the water or in the sulphuric acid which is generated, remains mixed with the oxide of iron, that constitutes the residuum. There is, in some cases, a gradual passage from the brilliant yellow pyrites into this brown or black iron ore.

The strata found in this tract, are varieties of slate and of various other rocks, frequently associated with this primary family. They are remarkable for being placed in a position, nearly or quite perpendicular: the strata stand on edge, or if inclined, they form but a small angle with a vertical line, and consequently, nearly or quite, a right angle with the horizon.

This position of the rocks is very advantageous to the working of the mines, because, the veins of auriferous quartz, being laid between the layers and strata of the rock, are therefore, like it, nearly or quite perpendicular—consequently, the working of the vein creates a vertical adit, in which the miners can stand erect, and when it is wrought quite to the surface of the ground, the opening will be a perpendicular fissure, of easy access.

The direction of the strata by compass, here conforms to the general geological structure of the gold region, and of the continent, being about N. by E. and S. by W.

That the gold region of Virginia, although of very unequal value, is, on the whole, rich in the precious metal, admits of no doubt. It appears also, from satisfactory evidence, that much gold has been already taken, from this vicinity, on both sides of the Rapidan river. Gold is obtained in probably all the branches. Hempstead gathered from the hill and chiefly from the shaft which bears his name, in 1831 and '32, about $4,000, and nearly $3,000 of this was obtained in sixty days: he was aided by only two men, two boys, and a two-ox team, and his excavations were not very considerable. Large sums have been taken from tracts on the opposite side of the river. Ten branches that were examined on this bank, all afforded gold; and out of about one hundred washings, almost all were successful. On Grimes' land, two or three miles from the river, 12 or $15,000 were obtained; and on Greenwood, not less than $40,000. Judge Coulter, immediately opposite, has taken up 10 or $12,000, and is obtaining more. The greater part of this gold was found by washing alluvial matters. On Greenwood there was a rich yield from a vein, and there are auriferous veins on all the above named tracts.

But the question of deepest interest is, what proportion of gold may be reasonably expected from this mine—from its auriferous quartz and their contents, and from the rocks themselves as far as they bear gold? Mining operations are always, to a degree, uncertain in their results. No knowledge or sagacity can enable us to decide, with absolute certainty, on the proportion of the desired treasure, which lies below; it may diminish—it may increase—it may vanish. In a country whose geological structure is uniform like the region before us—where the veins appear to be subject to little irregularity and to constitute an important and probably an original feature of the rocks, we can discern no reason why their metallic contents, and, in the present instance, why the proportion of the precious metal should diminish. That it is, however, very unequally distributed in the veins is manifest, and therefore a trial made in a single place might afford a result either too discouraging, or too flattering. With a view of avoiding, as far as possible, this source of error, portions of the ore were taken from various places; in the veins at the bottom of the shaft, and at the end of the adits; and also from the heaps

that had been thrown out of the mine. From fourteen or fifteen localities, including a great number of specimens and ore of all varieties, portions were knocked from each piece, crushed, ground and sifted: they were then washed in pans in the usual way: gold, in every instance, became visible to the naked eye in consequence of the washing, although little or none could be discerned in the fragments, even with the aid of a good magnifier. The gold, of all the washings, was then brought together and amalgamated with mercury that had been previously distilled; the amalgam was freed from redundant mercury, by straining it in leather; and being then decomposed by heat, so as to expel all the quicksilver, the remaining gold was carefully weighed.

Eleven pounds of the mixed ores, thus treated, gave a little over four grains of gold, which is in the proportion of thirty-seven grains to one hundred pounds, or one bushel of the ore—equalling in value, at the mint price of $4\frac{1}{2}$ cents for one grain—*one dollar and fifty cents.*

Another trial, upon a small number of pieces, gave one grain of gold from five pounds of the mixed ores: this is in the proportion of 82 cents for one hundred pounds of ore.

In still another experiment, ore was taken from a vein considered as decidedly rich, but shewing no visible gold. Two pounds of this ore gave two grains of gold, being the proportion of one grain to one pound—or one hundred grains to one hundred pounds of ore, and in value equal to $4 08.

The average of the two first and lowest trials, gives $1 16 to the one hundred pounds of ore: the average of the three trials is $2 13 to the one hundred pounds of ore.

The average of the two most favorable trials is $2 79 to the hundred pounds. I ought not to omit to state, that from a small quantity, perhaps two ounces of very unpromising fragments, a very rich washing of gold was obtained in my presence, far surpassing the results which I have above reported.

It has been already stated, that from information received from many quarters, respecting the expense of working the mines, it would appear that, in general, it does not exceed 30 to 35 cents on one hundred pounds of ore, and consequently the average trial on the large number of pieces presents a favorable result as regards the prospects of this mine. This is probably the trial which is most to be relied upon, and it was certainly a severe experiment for the

mine. It may be regarded as affording as fair an approximation to the real productiveness of the mine as can, at present, be obtained; for the ores were taken from every place in the hills where any diggings had been made, and no allowance was admitted for waste in washing. That this waste was of some moment, appears from the fact, that on washing again the matter which had flowed from the pans, a small portion of gold was, in every instance, obtained, even when the washings were, again and again, repeated, on the successive overflows of the pans.

This fact, always observable in a greater or less degree, in the washing of the gold, deserves to be particularly insisted on here. It is certain that an important proportion of the very fine particles of gold is usually lost in the washings. Those who are expert in this manipulation find, that a fourth, and even a fifth or a sixth washing will yield a valuable portion of fine gold.

This occurs more generally in the pyritical ores in which the gold is imbedded in excessively fine particles. This mass when reduced to fine powder, gives a residuum of oxidized iron, (commonly called black sand,) equal almost, in weight, to the fine gold, the latter being malleable or flattened, while the former, being brittle, remains rounded or angular; in washing this mixture in the pan, the gold generally remains on the upper side of the mass, and is therefore more liable to be washed off by the slightest ripple of the water. On the other hand, when the gold is imbedded in quartz ores, especially those with fine fractures, called in Virginia sugar ore—more properly granular quartz,* the gold being of a similar form, is more quickly disengaged, and appears in larger grains. On the contrary, the ferruginous grains or iron sand are so fine as to be scarcely visible, and are invariably found at the bottom of the mass or residuum, and therefore, as well as on account of their greater weight, are much less liable to be carried off by the ripple of the waters. In the purer quartz ores, ordinary care in the use of the pan will recover, at the first washing, a much greater proportion of the gold than in the other case, where repeated and careful repetition of the washings will never fail to give an additional yield. Hence arises the necessity of a different mode of operation upon the two kinds of ores; a view which a regular chemical essay would doubtless sustain.

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* See the preceding account of the Moss and Busby mine.

There is, therefore, no doubt that the result stated above is below the truth, as regards the quantity of gold; and still it would be better to calculate upon returns rather less than more, in relation to the operations in the large way. In estimating the actual results of the mining operations in the gold region, those concerned will of course take into view the interest of capital laid out in the purchase of the gold lands. On this point, I am not called upon to express an opinion.

Were it possible, however, it would be very desirable to extinguish the spirit of speculation which is producing a dangerous excitement in the public mind, equally hostile to the true interests of the mining region, and of the country, and dangerous to individuals. It would be very desirable that the mines should be purchased only by those who intend to explore them, and not by those who buy merely that they may sell again, perhaps at a very short period, and for a price suddenly advanced, not in consequence of actual returns from the mines, or of a reasonable prospect that they will soon be realized, but because the community is in a state of unnatural excitement.

Virginia has, in her territories, great mineral treasures; but they are to be obtained only by sober industry and skillful application of knowledge and capital; nor would all her hidden treasures of gold, if brought to light, form any adequate compensation for the abandonment of her agriculture and the substitution of a spirit of wild speculation.

The comparatively deep explorations of the Culpeper mines have probably developed, in a good degree, their real character, and there is therefore not so much danger of error as in those cases where the mining has been less thorough and less extensive.

This mine possesses also important advantages, in consequence of its great water power, and the favorable form of the ground, which will enable it to obtain a profitable return, not to be realized, in an equal degree, by a richer mine without similar advantages. It is not believed that this mine will need the application of steam power, certainly not for a long time, because the water can be drawn from the excavations either by gravity, or by machinery connected with the hydraulic power of the mills; and it is expected, even, that its superfluous force, that which is beyond what its own exigencies may require, will in the course of some time, be applied to aid the operation of the mines in the vicinity, not possessing hydraulic power.

In my investigations in the case of the Culpeper mine, and of other mines in the gold region of Virginia, I have received the able

and zealous assistance of Mr. Forrest Shepherd, whose minute acquaintance with the topography and peculiarities of this portion of the country, and whose knowledge of the sciences, which have a bearing on this subject, qualify him for extensive usefulness in this department of service, and justly entitle him to confidence.

Gold Districts of the Virginia and New England Mining Company, in Louisa County.

This tract, recently belonging to Mr. William Walton, contains 193¼ acres, and joins to the rich gold tract described above, and now the property of the Virginia Exploring and Mining Company, except that a narrow tract, called the Triple Fork, intervenes, which tract belongs to the Goochland Mining Company. This tract, which is about two hundred yards wide, does not differ materially from that of the Virginia Exploring and Mining Company. Like that land, this contains gold, but it has been only imperfectly explored. Two years ago, a shallow excavation was made, and by the use of a rocker, a few pennyweights were obtained each week, amounting in ten weeks to 680 pennyweights in the whole, and it is expected that the work will be resumed.

This tract appears to be a continuation of the same gold region, its geological structure being the same with that of the rich Walton territory above named. Slaty rocks form the common basis of the whole territory, and upon them lies gravel, then clay, and then soil and forest.

This portion of land is intersected by six veins of quartz, three of which appear very distinctly in the public road, one more obscurely, and one of them is believed to be the identical vein* which, near Mr. Walton's house, is very productive of gold;—no reason appears why it should not be equally productive here, but as it has not been opened, this cannot now be positively known, and it must be decided by future exploration.

No thorough investigation has, as yet, been in any way made upon the tract; mining has not been even begun, and only a few imperfect trials have been instituted for surface gold, by washing the gravel and other loose materials. As far as these trials have been made, they decidedly favor the opinion expressed above, as to the nature of

* On the authority of the county surveyor, Mr. Richardson.

the country. Several persons of good character stated to me, that they, by washing, had obtained gold upon this tract; and gold was procured on the lands, under my own eye, by the usual process of digging down to the gravel and washing; Mr. Forrest Shepherd, also, both now and formerly, procured the same result. These facts, taken in connection with the structure of the country, and with the additional fact, that in the immediate vicinity there is a rich gold mine, leave no doubt that this tract belongs to the same gold formation. The important question, whether this land contains gold enough to justify working it by superficial or by mining processes, can be decided only by actual trials. There appears sufficient encouragement to render it proper to expend a reasonable sum in digging into and washing the gravel in numerous places, and in opening the principal quartz veins, here and there, for a few feet or yards in depth.*

Fauquier and Culpeper Counties.

The extensive tracts about to be mentioned, in the counties of Fauquier and Culpeper, amount, collectively, to three thousand or four thousand acres, but in them no considerable explorations for gold have been made. There are no shafts or adits to afford facilities for observation, nor have even the alluvial deposits been, to any considerable extent, examined by the simple operations of the washing pan. It was not in my power to make any attempts of this nature: there were no means at hand for such purposes, nor was it in any way possible for me, at the time, to discharge the duties of the practical miner; I did, however, all that the circumstances of the case admitted.

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* I have recently seen a letter, dated Nov. 21, 1836, from a master miner on the spot, a man of skill and integrity, with whom I am personally acquainted, stating, that a very rich vein has been discovered upon the land adjoining this tract upon the south, and it is believed that the vein runs through the ground now under consideration. A new vein has also been discovered in the Walton territory, to the west of the main vein; it promises to be good. In support of the opinion that this is probably a valuable gold tract, may be cited all the facts detailed above respecting the Walton Mine, and also those relating to the numerous gold mines and deposits lying in this vicinity in several directions, and at a very moderate distance; these facts it is unnecessary to recapitulate, and their bearing upon the present case is too obvious to require an explanation. It would, indeed, be most extraordinary if this tract, being surrounded by gold, should itself afford none of the precious metal.

I visited and explored the tracts in question, on both sides of the river, after having also examined, to a sufficient extent, the adjacent gold mining estates.

My visit to these grounds was reserved for the last, among a series of examinations of gold mines, and of tracts of gold-producing lands, which occupied me during several weeks, and which carried me through a continued line in the gold region, extending from the Union mine, in Fauquier County, to the mines of Buckingham—about eighty miles.

During these investigations, in which I have been very ably assisted by persons having exact local knowledge, and much acquaintance with the peculiar indications of gold mines in the region in question, I myself acquired the requisite familiarity with the physical features of the country, and a degree of skill in judging of the indications that are important to be observed. My last occupation antecedent to visiting these lands, was in the grounds of the Culpeper Mining Company, on the Rapidan river, which forms the boundary, on one side, of the narrow neck of land included between the river just named and the Rappahannock: this tract does not, at this place, exceed three miles in breadth. The Culpeper mine, as appears from the facts stated above, is one of decided value.

For the same reason that I mentioned the Walton mine and other gold tracts in its immediate vicinity, in connexion with the notice of the lands of the Virginia and New England Company in Louisa County, I name the Culpeper mine here, and also the other mines in the same region,* because their vicinity to this tract makes them, in some measure, a key to the true nature of the territory. I allude to the gold mines that are intermediate between the Culpeper and the present territory, namely, the Rossin, the Cromarty, and the Millbank, all of which, we are assured, are valuable gold grounds, and they form an uninterrupted line of communication to these lands. I visited the Millbank mine, and although I had no opportunities of investigation while there, the favorable opinion entertained by the proprietors of the value of this mine, is sufficiently indicated by the extensive adit which they are now cutting there, preparatory to other still more important operations. The Millbank mine completes the series, beginning at the Culpeper and proceeding N. E. until we

* I am informed by Mr. James Williams, of Fredericksburg, that several places of richer ores have more recently been discovered at the Culpeper Mine.

F. Shepherd.

strike these grounds, which are immediately contiguous. It gives additional strength to this view, that the estates opposite to the Culpeper mine, and lying on the other side of the river Rapidan, are rich in gold.

There can be no doubt, therefore, as to the general nature of this region, and it remains only to inquire whether the peculiar features indicating gold are continued through the territory on both sides of the Rappahannock. To this question the answer is decidedly in the affirmative.

The ranges and strata, like those of the gold-bearing rocks, with their quartz veins, the same that, with slight variations of appearance, are seen through the gold region, are here conspicuous, passing under the river Rappahannock, and appearing in the lands on both its banks. The same slaty rocks that characterize the gold region elsewhere in Virginia, are seen here; as in many other places, they are highly inclined, and in general, the quartz veins have the same inclination as the strata and layers of rock, and lie between them. On the northeast side of the river, in the Mount Ephraim estate, the veins of quartz are large; their ruins are numerous, and lie in massy piles on the surface, presenting, sometimes, over a considerable surface of quartz, a delicate frosting of minute crystals of quartz, and at other times the crystals are distinct, having perfect forms. In the extensive tract on the southeast side of the river, the veins of quartz are numerous; they are not so large as on the other side, but they are better defined, and often assume a promising appearance, being accompanied by that bright or deep red earth, so commonly seen through the gold regions, and which has probably proceeded from the decomposition of pyrites, so frequent a companion of gold in Virginia.

In answer to the inquiry whether gold has been actually found upon any portion of these tracts, the facts are not numerous, but as far as they go they are satisfactory. We are credibly informed, that gold has been repeatedly found in both territories by washing; my witness is one who himself obtained the gold on the southeast side of the river, and he had the statement respecting the other side from a gentleman resident on the ground, and personally knowing to the facts.

It appears, then, that there is sufficient encouragement to justify an examination of these grounds in the usual way, and that it is decidedly proper to expend a sufficient sum in washing, upon all

the branches, and in opening several of the veins of quartz on both sides of the river.

A person accustomed to the indications of gold in this region, would, in the course of a few weeks or months, be able to make up an opinion which might guide future researches or decide the previous question. There is a large tract of low meadow ground on the Mount Ephraim estate, which greatly resembles, in its general features, the grounds that are now profitably washed for gold at the Whitehall mines in Spotsylvania county: this tract ought to be examined by digging to the slate, and washing the gravel lying above it.

There can be no reason to doubt, that both in the washings of the alluvial matters and in the regular quartz veins, gold will be found. It is, however, impossible to predict in what quantity, but as rich disclosures of gold have been made in the immediate vicinity, as these tracts present the peculiar features of the gold region, and as some gold has been found upon them, a favorable result may be reasonably looked for, although nothing but actual trials will give full assurance. These tracts have important natural advantages. A great river, affording unlimited hydraulic power, passes through the lands. Their elevation above the water insures an easy drainage, and there is a large quantity of good timber; all these resources would, in case of actual mining, prove of great importance.

Remark.—In the experiments of a public course of chemistry, I have recently used portions of the gold which I extracted at the Virginia mines; it proved remarkably pure, and gave fine results in every instance in which it was tried.

Art. XI.—*Notice of some facts connected with the Gold of a portion of North Carolina;* in a letter to the Editor, dated Charlotte, (N. C.) June 6, 1831, from Franklin L. Smith, Esq.

Remark.—The publication of this letter, so many years after its date, demands an explanation, which will be given in another way to the writer. To the public it is sufficient to say, that it was called out from the files where it had lain so long, in consequence of the interest excited in the Editor's mind by his recent examination of the gold region of Virginia; and on account of the striking similarity of most of the facts stated in this letter, to those which he there saw,